

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Expanding Flexible Use in Mid-Band)	
Spectrum Between 3.7 and 24 GHz)	GN Docket No. 17-183
)	

REPLY COMMENTS OF ALTEROS, INC.

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Summary

Alteros points out that millions of consumers already benefit from products and services operating in the Lower and Upper 6 GHz bands as a result of the FCC's efficient spectrum sharing policies and existing Part 15 rules. While Alteros supports unlicensed operations in the Lower and Upper 6 GHz bands (5.925-6.425 GHz and 6.425-7.125 GHz), such operations must comply with existing technical standards that have been carefully crafted to protect critical safety and infrastructure operations in the 6 -10 GHz bands. Relaxing current technical standards to allow large numbers of mobile broadband devices to operate on frequencies, antennas and connection paths in close proximity to the very frequency bands that are used to operate the nation's power grid or support public safety operations poses an unwarranted security risk, would raise the noise floor in the 6 GHz band to levels that would degrade existing licensed operations and would present difficulties in identifying and remediating the source of any interference. Based on similar unlicensed operations in the 5.8 GHz band, technical evidence already suggests that relaxing the existing technical rules governing operations in the 6 GHz band will invariably degrade existing licensed and unlicensed operations.

Advocates of allowing expansion of WiFi into the 6 GHz band are seeking rule changes not because the Commission's current rules prevent unlicensed operations in the 6 GHz band but because, in their own words, it would be "impossible" for them to deploy WiFi systems under the current technical rules, rules which were carefully designed to encourage spectrum sharing in the band and to protect critical wireless infrastructure. These advocates do not seek access to the 6 GHz band because of any inherent characteristics of that spectrum but rather because they mistakenly believe it is cheaper and more convenient for them to utilize based on proximity to their 5 GHz operations. In fact, the bands below 6 GHz and above 24 GHz are far better suited for WiFi deployment for a number of technical and policy reasons. Frequencies below 6 GHz are superior for applications that require extended range while frequencies above 24 GHz allow for smaller antenna arrays, support greater information carrying capacity and are generally more spectrally efficient. It is also significant that international broadband deployment is occurring not at 6 GHz but at frequencies below 6 GHz and above 28 GHz. If the United States desires to remain a global market leader, its policies must be harmonized with other countries. It should not be overlooked that one important component of U.S. technical and economic superiority is the

development of a broad base of innovative wireless technology devices and methods, rather than a sole focus on WiFi or mobile broadband.

There are many unlicensed users of spectrum between 6 GHz and 10 GHz who have spent millions of dollars to develop innovative new products that co-exist harmoniously with critical licensed infrastructure in accordance with existing technical standards. Many of these users did exactly what the Commission asked them to do—that is, to find a way to develop spectrally efficient and innovative products that could share spectrum with existing licensed services as the amount of available spectrum below 1 GHz was being significantly reduced. These innovators found ways to do so under the current regulatory scheme and did not ask for special treatment or to change a regulatory scheme that had been carefully crafted over time to protect critical infrastructure. It is possible to protect the safety of the American public, while at the same time allowing the existing rules to drive very efficient spectrum sharing and innovation.

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Alteros, Inc. (“Alteros”) submits these reply comments in response to the Notice of Inquiry (“NOI”) released by the Commission in the above-captioned proceeding on August 3, 2017.¹ In response to the NOI, a large number of parties submitted comments both supporting and opposing expanded access to various portions of the mid-band spectrum between 3.7 and 24 GHz. These reply comments respond to proposals by various parties that would have the effect of disrupting the carefully crafted spectrum ecosystem established by the Commission after many proceedings and based on years of experience under which both licensed and unlicensed services are able to harmoniously share spectrum and conduct their operations in the 6 - 10 GHz portions of the mid-band.²

I. INTRODUCTION.

Alteros, an Audio-Technica company, was formed in 2016 and is dedicated to the research, development, and sales of innovative technology products with a special focus on the evolving RF landscape and to creating high-end wireless solutions for live audio production,

¹ *In the Matter of Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, GN Docket No. 17-183, FCC 17-104 (rel. August 3, 2017).

² Alteros takes no position on allowing expanded use of 3.7-4.2 GHz for wireless broadband services.

broadcast studios, sports events, and theater applications in the ever shrinking frequency spectrum. Alteros products capitalize on Audio-Technica's extensive research in ultra-wideband ("UWB") and RF technology and innovative digital solutions to solve the most demanding technical problems. As spectrum for high profile events has become more and more compromised, Alteros was formed in response to the FCC's desire to develop technology solutions that will allow wireless microphones and other broadcast auxiliary services, both license and unlicensed, to successfully operate outside of the television bands without disrupting existing licensed services. To this end, Audio-Technica invested millions of dollars in the research, development, production and launch of the world's first ultra-wideband digital wireless microphone system and then followed this innovation with the formation of the new company, Alteros, which in under a year is already winning awards and recognition for designing and providing technically-advanced digital wireless products used in the highest level venues and most critical performance applications.

Prior to the formation of Alteros, Audio-Technica was an active participant in the Commission's ongoing proceeding to allow unlicensed devices to operate within the television white spaces ("WSDs") and to establish rules to ensure that such operations do not interfere with licensed and unlicensed wireless microphones. Audio-Technica has not opposed allowing unlicensed operations on vacant television broadcast spectrum but has asked the FCC to ensure that the particular interference vulnerabilities of low power broadcast auxiliary stations, particularly wireless microphones, are taken into account and fully addressed in any decision to allow unlicensed operation in the TV Bands. Similarly, Alteros does not oppose allowing

additional unlicensed fixed operations in the mid-band as long as such operations are required to meet the same technical standards that existing unlicensed operations in that band are required to meet. The Commission should not adopt special rules that will favor one class of unlicensed wireless users over another.

II. CRITICAL SAFETY AND INFRASTRUCTURE OPERATIONS BETWEEN 6 AND 10 GHZ MUST BE PROTECTED.

The 6 GHz band is already heavily used by a number of licensed and unlicensed services – creating exactly the type of highly efficient spectrum sharing/utilization that the FCC often states is their goal. The comments of the National Spectrum Management Association (“NSMA”) provide excellent documentation regarding the successful management and sharing of the tens of thousands of devices (reaching millions of consumers) co-existing in the bands 3.7-4.2 GHz, 5.925-6.425 GHz and 6.425-7.125 GHz.³ Those comments point out that in particular, the Lower and Upper 6 GHz bands (5.925-6.425 GHz and 6.425-7.125 GHz) are used for fixed point-to-point terrestrial microwave systems by cellular network operators (including 911 support), oil and gas pipeline operation (requiring real time reliable control), railroad companies, electrical power grid operation (to maintain grid stability and availability), and state and local governments for use in providing critical commercial and public safety services.⁴ Alteros agrees with NSMA’s comments that the loss of quality to any of the existing networks would seriously impact the safety and quality of life of many American citizens.

³ NSMA Comments at pp.3-6.

⁴ *Id.* at p.5.

Alteros shares the concerns expressed by the power industry, which generally opposes opening up the 6 GHz band for fixed and mobile broadband use, that such use would threaten to cause interference to the mission critical communications fixed microwave systems utilities use to support the safe, reliable and secure delivery of essential electric, gas and water services to the public at large.⁵ UTC/EEI correctly raise concerns that the allowing the aggregated operation of large numbers of unlicensed devices will raise the noise floor in the 6 GHz band to levels that would adversely impact mission critical communications.⁶ And Southern correctly points out that spectrum sharing between mobile devices and existing fixed services is particularly problematic due to the dynamic and changing spectrum environment that characterizes mobile operations and the difficulty in identifying sources of interference where those mobile operations are unlicensed.⁷ Alteros would add that as a common sense and security matter, the last thing the Commission should do is risk public safety by setting up close-functioning broadband access via similar frequencies, antennas and connection paths to the very frequency bands that are used to operate the nation's power grid.

Alteros also shares the concerns expressed in the comments of American Cable Association ("ACA") which cautions that expanding access to the 6 GHz band should not be permitted to disrupt or degrade the video distribution architecture that allows nearly 2,000 channels of video programming to be distributed to customers nationwide, including to millions

⁵ Comment of Southern Company Services ("Southern") at p.2; Comments of the Utilities Technology Council (UTC") and the Edison Electric Institute ("EEI").

⁶ UTC/EEI Comments at p. 12

⁷ Southern Comments at pp. 4, 6.

of Americans residing in the nation's rural heartland.⁸ Alteros' concerns, however, go beyond protecting licensed content distribution channels and extends to protecting the myriad of unlicensed content creators that have migrated from the 600 MHz and 700 MHz bands to the 6 - 10 GHz bands in response to the Commission's reclamation and repurposing of spectrum below 1 GHz for commercial fixed and mobile broadband use.

The broadcast and entertainment industries rely on spectrum in the 6 GHz band for wireless cameras, wireless microphones, and video feeds to "jumbotrons" screens to enhance fan experiences in many venues across the country. These applications utilize new equipment and new technology developed and implemented at the cost of millions of dollars in response to lower-band spectrum re-allocations. A number of real-time location devices operate in these bands, including Zebra Technology's UWB player tags deployed in every NFL stadium, or their Dart RTLS systems used in safety applications, and products from DecaWave, Indotraq, and Secure Corp all operate in these bands. All these devices have been developed to operate in efficient spectral harmony with national infrastructure use. Creating a new use case which would conflict with all these user applications would compromise spectrum efficiency, would limit innovation and novel uses of wireless, would negatively impact the daily use of important telecommunications and entertainment equipment, and would risk the safety of Americans.⁹

⁸ ACA Comments at p.3.

⁹ *See also*, Comments of the MVDDS 5G Coalition at pp. 8-9 ("The Commission would not be able to transition or develop any of the specific frequency bands identified in the Mid-Band Spectrum NOI for 5G services as readily as the 12 GHz Band. None of the identified bands, unlike the 12 GHz Band, has a developed record regarding flexible, mobile use and the 5.945-6.425 and 6.425-7.125 GHz bands have tens of thousands of stations are highly encumbered.").

III. MODIFICATION OF CURRENT TECHNICAL RULES IN THE 6 GHZ BAND TO FAVOR ONE INDUSTRY WOULD BE A MASSIVE MISTAKE

There is sound technical evidence and previous case experience which indicates that use of the 6 GHz band for devices other than those that have currently evolved to operate under the current regulations will result in performance risks which cannot be practically overcome by new power, databases or operating area rules due to a mismatch between the power/connectivity requirements and the itinerate and pervasive nature of potential new devices and the operational requirements of existing infrastructure. The Commission is well aware of the difficulties of allowing unlicensed devices to share spectrum with public safety and other critical infrastructure and has put in place carefully considered regulations to prevent the spectrum noise floor from causing adverse and dangerous effects to existing infrastructure systems. The spectral density limits already established for 5.925-7.125 GHz spectrum were developed after an arduous and thorough process to adopt rule section 15.250 dealing with the operation of wideband systems between 5925 MHz and 7250 MHz and Part 15, Subpart F dealing with ultra-wideband operations generally. The Commission's Office of Engineering and Technology ("OET") has recognized the need for operational restrictions and protection of critical incumbent users in these bands, and should not now be considering new rules which would directly conflict with these protections.

As correctly pointed out in the comments filed by NSMA, even very weak signals, well below the microwave receiver threshold, can degrade existing services especially in cases where a large number of wireless devices are deployed, as the aggregated power of multiple transmissions will create interference in situations where one or a few mobile transmissions

might not.¹⁰ NSMA also points out that “[t]his effect (the artificial raising of the radio receiver noise floor) is noticeable today in many cities in the 5.8 GHz unlicensed band.”¹¹ Thus, technical evidence already exists that relaxing the existing technical rules governing operations in the 6 GHz band will invariably degrade existing licensed and unlicensed operations in this band.

In part for this reason, allowing wireless broadband into the 6 GHz band has been opposed by public safety concerns, such as Los Angeles County, California, the City and County of Denver, Colorado, the City of Kansas City, Missouri, Ozaukee County, Wisconsin, and the Government Wireless Technology & Communications Association (“Joint Commenters”) who utilize 6 GHz microwave stations extensively as part of their public safety networks and who have had extensive experience in dealing with interference mitigation problems that arose in connection with 800 MHz rebanding.¹²

Alteros agrees that 5G superiority is important to the United States, and acknowledges that obstacles to Small Cell Infrastructure are one current issue limiting successful deployment. However, asking city and local governments to compromise their safety and services which utilize mid-band infrastructure and to require them to allow replacement infrastructure (such as multiple devices placed on light poles) in these bands to operate WiFi and other mobile uses makes no sense. One has only to look at the number of comments from utility and local entities

¹⁰ NSMA Comments at p. 11.

¹¹ *Id.*

¹² Joint Comments at pp. 4-5. *See also*, Comments of the National Public Safety Telecommunications Council; Comments of Duke Energy Corporation; Comments of Tucson Electric Power; and Comments of UTC/EEL.

to understand the importance of finding alternative (higher) spectrum that will work in harmony with important local infrastructure instead of against it.

The Commission should not overlook the fact that advocates of allowing expansion of WiFi into the 6 GHz band are seeking rule changes not because the Commission's current rules prevent unlicensed operations in the 6 GHz band but because, in their own words, it would be "impossible" for them to deploy WiFi systems under the current technical rules designed to encourage spectrum sharing in the band and to protect of critical wireless infrastructure.¹³ In effect, these advocates are asking the Commission to change the rules under which a varied ecosystem of licensed and unlicensed services, users, and technologies are able to successfully thrive and share spectrum just so they can extend WiFi services more cheaply than they could in other frequency bands, such as 24 GHz and above, that are technically superior for mobile broadband applications, underutilized and available for broadband deployment.

It is clear from the comments of the WiFi advocates that should they obtain access to the 6 GHz band, they have no intention of protecting existing unlicensed users and while they give lip service to protecting licensed incumbents their track record in this regard is less than stellar. The Commission must not forget or ignore the fact that in originally advocating opening up the TV White Spaces for unlicensed use, these same proponents made a number of claims that their devices could and would be equipped with spectrum sensing technology to ensure that their operations would not interfere with other licensed users (including licensed wireless

¹³ See, e.g., Comments of All Points Broadband *et al.* at p.1 ("Commission rules already allow other types of Part 15 operations in this band. But the existing rules make broadband operations impossible.").

microphones) operating in the TV Bands. Based upon demonstrated interference concerns that WSD deployment presented to licensed wireless microphone operations, the Commission's White Spaces rules, as originally adopted, required that WSDs be equipped with effective spectrum sensing capabilities.

During the Commission's equipment certification process for WSDs, it quickly became apparent that despite all the ballyhoo over spectrum sensing, none of the white spaces devices for which approval was sought could detect and avoid interfering with wireless microphones on a consistent basis. Simply put, spectrum sensing technology, a technology that holds great potential to improve spectrum efficiency and allow greater spectrum sharing was still not ready for prime time. Despite the shortcomings in the current generation of spectrum sensing technology, or perhaps because of them, WSD proponents were able to convince the Commission on reconsideration of its White Spaces rules to remove the spectrum sensing requirement. In doing so, WSD interests argued that spectrum sensing was redundant and unnecessary because licensed interests would be fully protected by their proposed geo-location database solution. However even today that database system has not been fully implemented and the Commission has twice now had to waive the deadline for WSD's to implement enhanced "push" capabilities required to protect licensed operations in the band because no equipment capable of meeting the enhanced push requirements has yet been certified.¹⁴

¹⁴ *Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37*, Order, 31 FCC Rcd 13798 (2016); *further extended by Order*, DA 17-900 (rel. September 15, 2017).

Simply put, new rules for unlicensed devices operating in the 6 GHz band are not needed, as this spectrum is already extensively and successfully utilized by both licensed and unlicensed services.¹⁵ Part 15 rules already exist for 5.925 – 7.125 GHz, and these rules have fostered the development and use of unlicensed devices that protect incumbent users in these bands, consistent with the Commission’s stated goal of efficient spectrum sharing.

IV. THERE ARE BETTER ALTERNATIVES THAN 6 GHZ FOR MOBILE BROADBAND DEVELOPMENT

Apart from the interference risk posed to critical infrastructure and existing licensed and unlicensed services, the fact is that the 6 GHz band is not the best alternative for additional spectrum to support mobile broadband deployment for a number of reasons. Rather, rapid mobile broadband would be best accomplished with development below 6 GHz and above 24 GHz. Due to both technical limitations and the existence of important global infrastructure incumbent users, there is simply not enough usable and unencumbered bandwidth available between 6 – 10 GHz to support the very high throughput data links required for the rapid growth of mobile traffic.

A recent feasibility study undertaken by the International Telecommunications Union (“ITU”) discusses in detail the technical feasibility of mobile use in bands above 6 GHz.¹⁶ Due to certain band utilizations and technical characteristics, all studies for use above 6 GHz begin at

¹⁵ Comments such as those of Qualcomm that suggest “there currently is no unlicensed broadband allocation in the 6 GHz bands” are simply incorrect. Qualcomm Comments at p.8. A large population of unlicensed devices have been developed and deployed in response to the FCC’s policies and technical requirements and continue to drive innovation in these bands. These devices are in daily use, and are pervasive throughout the U.S.

¹⁶ Report ITU-R M.2376-0 (07/2015), “Technical Feasibility of IMT in Bands Above 6 GHz.”

10 GHz. That study provided evidence that the most dramatic effects and highest rate of performance change due to atmospheric conditions exist in the 6 – 10 GHz frequency ranges.¹⁷ Frequencies above 20 GHz display much more consistent effect and thus it is more feasible to develop equipment which operates consistently. The rapidly rising attenuation characteristics in the 6 – 10 GHz region have resulted in a “best fit” scenario of technology development in which devices which are designed to operate in limited distances have evolved. This is not practical for mobile devices requiring longer operational distances.

There are other reasons why frequencies above 20 GHz are better candidates for wireless mobile broadband applications than the 6 - 10 GHz bands. For example, one technology advantage of millimeter wave devices is an inherently small antenna. Denser, more compact antenna arrays can achieve greatly increased antenna gain for accomplishing effective link budget via high directionality and beamsteering, accomplishing good link budget in small cell implementations. However, in the region between 6 - 10 GHz, antennas and arrays are aesthetically large and impractical for deployment in some settings, such as the urban light post settings, which would be highly desirable to obtain uniform geographic coverage.

Another consideration is antenna coupling. Reducing spatial correlation between antennas is much easier as frequencies increase. The required antenna separation distance is approximately 10% of the wavelength, making some mobile device applications impractical at frequencies under 24 GHz. Higher frequencies also allow higher bandwidth implementations. Broadband filtering is essential to meeting flexible and increasing demand shared over the widest

¹⁷ Report ITU-R M.2376-0 at p.6, Figure 1 Atmospheric attenuation vs. frequency.

possible spectrum. Current filter technologies limit filter bandwidth to 3 - 4% of the center frequency of the band. At 6 GHz, that means the maximum channel bandwidth is limited to 240MHz. This is not a practical amount for mobile broadband implementation.¹⁸

Apart from technical considerations is the fact that international broadband deployment is occurring not at 6 GHz but at frequencies below 6 GHz and above 28 GHz. If the United States desires to remain a global market leader, its policies must be harmonized with other countries. Such harmonization will provide the best possible incentives for U.S. companies to develop equipment and technology for a mobile lifestyle that can be used worldwide and allow companies to take advantage of the manufacturing economies of scale presented by a global market. Substantial technological developments and parts availability for operation in frequency bands above 28 GHz offer a globally harmonized opportunity to meet the growing mobile device operation with better performance benefits than a “compromised” short-term deployment in the 6 GHz range.

It should not be overlooked that one important component of U.S. technical and economic superiority is the development of a broad base of wireless technology devices and methods, rather than a sole focus on WiFi or mobile broadband. Wireless technology supports

¹⁸ See e.g., Comments of Elefante Group at p.10 (“each airship platform will require, in an ideal deployment, use of at least 1.25 gigahertz of spectrum in each direction to support both platform-to-user and user-to-platform communications. This includes at least one gigahertz total bandwidth in each direction for regular operations and at least 250 megahertz bandwidth required for platform handovers to support servicing and upgrades and ensure there is no disruption in service. Further efforts by Elefante Group and Lockheed Martin to achieve compatibility with incumbent systems may indicate the need for consideration of supplemental spectrum from other bands, likely higher than 24 GHz, to achieve performance requirements.” (citations omitted)).

many essential safety, communication, control and reporting functions. Regulations must continue to support a broad range of technologies and spectrum utilization.

V. CHANGING THE RULES OF THE ROAD FOR 6 GHZ WILL DESTROY RATHER THAN FOSTER INNOVATION

It seems that every time there is a proposal to re-arrange spectrum use in favor of large broadband companies, one of the arguments is that it will “drive innovation.” Ironically, it is common knowledge that the largest companies are not the typical source of cutting-edge innovation. It is the small and start-up companies that drive the forward edge of innovation. Many smaller companies, including Audio-Technica’s spin-off company Alteros, innovated in response to the Commission’s reclamation of the 700 MHz band and in response to the recent 600MHz auction. Many of these companies, including Alteros, also invested millions of dollars and created new, truly innovative and technically-advanced equipment that would operate in the already heavily crowded but unique 6 – 10 GHz spectrum in the manner the FCC stated that it wished to see for future spectrum use: using technology to efficiently operate and share scarce spectrum. These innovators found ways to do so under the current regulatory scheme and did not ask for special treatment or to change a regulatory scheme that had been carefully crafted over time to protect critical infrastructure. If the FCC wishes to drive innovation, it cannot continually re-arrange the spectrum in which innovators have developed and flourished. It will become unsafe to innovate for smaller companies that are the drivers of innovation.

The main argument raised by the WiFi advocates for access to the 6 GHz band is that this band is adjacent to the spectrum in the 5 GHz band that is already being utilized for unlicensed WiFi and mobile broadband operations. In other words, it is convenient and cheaper for them to

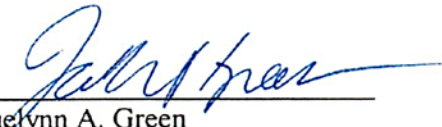
expand their operations into the 6 GHz band rather than seeking to deploy spectrum in other bands that may be more suited to their operations at a higher cost. That is not innovation but rather opportunistic developmental "creep" which threatens to degrade essential safety and services and displace well utilized spectrum sharing in return for a very small and inadequate slice of spectrum that represents an easy "add on" to existing operations. This is rather short sighted given that the actual solution to finding more spectrum for WiFi and mobile broadband is already being driven by market forces to higher bands, where the power/bandwidth/performance/ equation actually works and suits the larger demand, and to lower bands where propagation and coverage can be addressed more efficiently.

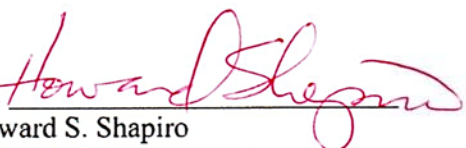
VI. CONCLUSION.

Based on the foregoing, Alteros respectfully requests that the Commission keep intact its current technical rules governing the unlicensed operations 5.925-6.425 GHz and 6.425-7.125 GHz bands.

Respectfully submitted,

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